Art-34 Sub 61

CLAIMS

7. A method of reconstructing tomography images comprising:

acquiring data on the geometric coordinates of detection of individual radiation events;

separately distributing a weight of each of the individual radiation events along a line of flight associated with the event determined from the acquired data on the geometric coordinates of detection of the individual event; and

iteratively reconstructing the image based on the distributed weights.

2. A method according to claim 1 wherein the weights are distributed in voxels along the line of flight and wherein the weight of a particular event is distributed based on the probability that an event occurred in particular voxels.

3. A method according to claim 1 ~~or claim 2~~ wherein the line of flight of an event is determined based on the position at which the event was detected on a detector and the acceptance direction of a collimator through which the detector receives radiation associated with the events.

4. A method according to claim 1 ~~or claim 2~~ wherein the line of flight of an event is determined by the position on a detector on which the event is detected and the location of the source of radiation associated with the event.

5. A method according to claim 1 ~~or claim 2~~ wherein the line of flight associated with an event is determined by detection of two coincident photons.

6. A method according to claim 1 ~~any of the preceeding claims~~ wherein iteratively reconstructing the image comprises applying an iterative expectation maximization (EM) method on the data in sub-sets.

7. A method according to claim 6 wherein the individual events form the separate sub-sets.

8. A method according to claim 6 ~~or claim 7~~ wherein the sub-sets are formed based on the time of acquisition of events.

9. A method according to claim 6 wherein the sub-sets are formed from unrelated events.

10. A method of reconstructing tomography images comprising:

acquiring data on the geometric coordinates of detection of individual radiation events; and

applying an iterative expectation maximization (EM) method on the data in sub-sets which are formed based on the time of acquisition of the data on the geometric coordinates of detection of the events.

11. A method according to ~~any of claims 6-10~~ claim 6 or claim 10 wherein the subsets consist of data having less than a 180 degree view angle.

12. A method according to ~~any of claims 6-11~~ claim 6 or claim 10 wherein iterations of the EM method are performed prior to the acquisition of data having a 180 degree angle of view.

13. A method according to ~~any of claims 6-12~~ claim 6 or claim 10 wherein iterations are commenced on receipt of the first detected event.

14. A method according to ~~any of claims 6-13~~ claim 6 or claim 10 comprising displaying an evolving image based on successive iterations iterative method on a display device.

15. A method according to ~~any of claims 6-14~~ claim 6 or claim 10 and including determining if a study should be terminated based on the image quality of an image after an iteration.

16. A method according to ~~any of claims 6-15~~ claim 6 or claim 10 wherein intermediate images are filtered with a smoothing filter between iterations of the EM method.

17. A method according to ~~any of claims 6-15~~ claim 6 or claim 10 wherein intermediate images are filtered with a noise reducing filter between iterations of the EM method.

18. A method according to ~~any of claims 6-17~~ claim 6 or claim 10 wherein data is reused in subsequent iterations of the EM algorithm.

19. A method according to ~~any of the preceding claims~~ claim 1 or claim 10 wherein the image is a three dimensional image.

20. A method according to ~~any of the preceding claims~~ claim 1 or claim 19 wherein the iterative method comprises reconstructing from the events without forming two dimensional data sets.

21. A method according to ~~any of the preceding claims~~ claim 1 or claim 19 wherein the iterative method comprises reconstructing from the events without forming sinograms for slices of the three dimensional image.

22. A method of reconstructing tomography images comprising:

acquiring data on the geometric coordinates of detection of individual radiation events; and

iteratively reconstructing a three-dimensional image from the unbinned individual radiation events.

23. A method according to claim 22 wherein reconstructing the image comprises utilizing an expectation maximization (EM) method acting on individual unbinned events.

24. A method according to any of ~~the preceding claims~~ claims 1, 19 or 22 wherein the radiation events are nuclear emission events and the images are emission tomography images.

25. A method according to ~~any claims 1-24~~ claims 1, 19 or 22 wherein the radiation events are positron decay events and wherein the images are PET images.

26. A method according to ~~any of claims 1-24~~ claims 1, 19 or 22 wherein the radiation events are represented by photons which have passed through a subject and wherein the images are transmission tomography images.

27. A method according to claim 26 wherein the radiation events are nuclear disintegrations and wherein the images are nuclear transmission tomographic images.

28. A method according to claim 26 wherein the radiation events are X-rays and wherein the images are X-ray CT images.

29. A method according to any of ~~the preceding claims~~ claims 1, 19 or 22 wherein the line of flight associated with the radiation events form a fan beam.

30. A method according to ~~any of claims 1-28~~ claims 1, 16 or 22 wherein the lines of flight associated with the events form a cone beam.

31. A method of reconstructing positron emission tomography (PET) images comprising:

acquiring data on the geometric coordinates of detection of individual positron emission tomography events utilizing a plurality of spatially continuous area detectors; and

reconstructing the image utilizing an expectation maximization (EM) method acting on individual unbinned events.

32. A method according to claim ~~30~~ 31 wherein the spatially continuous detectors are substantially planar detectors.

33. A method of reconstructing positron emission tomography (PET) images comprising:

acquiring data on the geometric coordinates of detection of individual positron emission tomography events utilizing a plurality of substantially planar area detectors; and

reconstructing the image utilizing an expectation maximization (EM) method acting on individual unbinned events.

34. A method according to any of claims 31-33 wherein the plurality of detectors consists of two such detectors.

35. A method according to any of claims 31-~~34~~ 33 wherein the images are three dimensional images.